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Studies on the Common Preservatives and Additives and their Nutritional Values used in the South Indian Food Industry

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ABSTRACT

The study aims at the screening of selected preservatives and additives with respect to its nutritional values. For centuries man has treated food to prolong to its shelf life, and now a days both the natural syntactic preservatives and additives are used widely to ensure the satisfactory maintenance of the quality, quantity and safety of foods. The food preservatives and additives are selected based on the food industries and purchased and measured. Nutrition values i.e., energy, carbohydrates, fats, proteins, fibre and sugar is analysed for the selective additives and preservatives. There continues to be lots of public concern about the use of food preservatives including additives leads from a perception that some of them may have undesirable effects on human body and their daily lifestyle. The absence of nutritional values in food additives and food preservatives are analysed by means of confirmatory tests. The results of these assays prove that there is no presence of nutrients in the additives and preservatives which are commonly used in south Indian food industries.

KEYWORDS: *Food Preservatives, Food Additives, Natural Additives, Synthetic Preservatives, Antimicrobials, Nutritional Values, Sweeteners, Emulsifiers, Stabilizers*

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INTRODUCTION

Preservatives have become an increasingly important practice in modern food technology given the growing demands for processed and convenience foods. However, consumption of preservative at concentrations above permitted safety standards might be harmful. For instance, benzoic and sorbic acids and their salt derivatives generate side-effects in sensitive individuals, causing asthma, urticaria, metabolic acidosis and convulsions. Other commonly used preservatives, 4-hydroxy benzoic esters (parabens), have been reported to accumulate in vivo through skin absorption and lead to androgenic disorders. Symptoms of excess dehydroacetic acid (DHA) and its sodium salt in rats include weight loss, emaciation, bleed in the stomach, congested mucosa. Thus, it is important to develop an analytical method for the determination of these preservatives and assure food safety (Ding et al., 2018). Preservatives and additives are substances used to prevent undesirable changes in foods during storage and transportation. Consumer demand tends to nutritious, artificial additive-free, ready-to-eat, and long shelf-life foods. This situation is the reason for pressure on researchers to study alternative additives to obtain safe and healthy food. The importance of natural preservative compounds is increasing due to the more extensive use of such compounds in food rather than synthetic compounds. Preservatives are sub-divided into three groups; antimicrobials, antioxidants, and antibrowning agent (Gokoglu, 2019).

Food additives are classified for various purposes. These are preservatives, texture developers, aroma and colour developers, nutritional value protectors and developers, etc. It has been stated that food additives can be divided into six groups of molecules: preservatives, nutritional additives, coloring agents, flavoring agents, texturizing agents and miscellaneous agents. Most of the additives have more than one function. Many preservatives from the past to the present have been used for all kinds of food.

However, the concerns about the safety of these preservatives have never decreased. Since that time, although some insecurity still continues, it is reported that the relationship between the additive and the consumer has improved.

The overwhelming growth of the world population over the past few decades associated with consumer concern has forced the food industry to find alternatives to synthetic additives in order to meet consumers' expectations and ensuring the global quality of the food products including aspect, texture and flavor Due to great advances in food technology, there are currently a wide variety of additives, being estimated over 2500 different types that are used by the food industry to achieve the desired effects in food(Takwa et al., 2018).

During the last decades, the global dynamics in food production and consumption have evolved rapidly. The FAO estimated that the (per capita) calorie availability of 2196

kcal/day in 1961 raised to 2870 kcal/day in 2011. On one hand, the increase in prices has led to an oversupply, on the other hand the unequal distribution of production and income has exacerbated the problems of access to food). As a result, the measurement and investigation of the access to food, a key dimension of food security, has become a priority in developed and developing countries. A further aspect of high relevance is the assurance of adequate nutritional quality and quantity, which also impact on food security status. Changes in income and prices have been proved to be potentially disruptive for the correct balancing of the diet. Moreover, the recent economic crises, joined to the high price volatility, have had severe consequences on global trade, global production and thus, on global availability of food. It is not surprising that diets have become less and less balanced. The prevalence of diseases linked to the consumption of unbalanced diets increased (Santeramo et al., 2018).

For this reason, the market of fresh produce has grown rapidly as a result of changes in consumer alimentary attitude, since there are more evidences to support the alleviation of many degenerative diseases, coronary heart disease, cancer, and in general population ageing. The beneficial effects on human health by consumption of fresh fruits and vegetables have been attributed to their high content of vitamin, fibre, mineral, and antioxidant that act as fine receptors against free-radicals. Ascorbic acid and beta-carotene are, for example, the main antioxidants present in the greatest amounts in fresh produce. From about 1, 100 fresh produce reporting outbreaks in which at least one biotic agent was identified as human pathogen, about 53% of them were caused by bacteria, 42. 5% by viruses, and 4. 5% by other parasites (De Corato, 2020).

MATERIALS AND METHODS

Collection of the samples

The most commonly used Preservatives and Additives used in the Food Industry are being analysed. Thus consolidated the list of Preservatives and Additives and collected from various sources.

Nutitional value Analysis

The Nutritional value is the measure of a well-balanced ratio of various nutrients such as Carbohydrate, Protein, Fats and oils, Fibre, sugar and Energy. Hence for the analysis of these Nutrients the Standard proven procedure is being followed. (Appenroth, 2017)(Manzi, 2001)

RESULTS AND DISCUSSION

Selected Preservatives

- Castor oil
- Citric Acid
- Vinegar
- Sodium Chloride
- Sorbic Acid

Selected Additives

- High Fructose Corn syrup
- Calcium Aluminium Silicate
- Stearic Acid
- Monosodium Glutamate

Nutritional values of selected Preservatives Castor oil

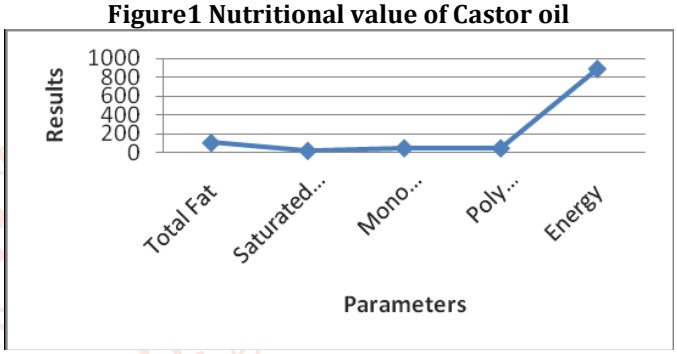
Castor oil is a vegetable oil pressed from Castor beans. Castor oil is a colourless to very pale yellow liquid with a distinct taste and odour. In India, Food grains are preserved by the application of Castor oil. It stops Rice, Wheat and pulses from rotting.

Table 1 Nutritional value of Castor oil

PARAMETERS	RESULTS (g/100g)
Total Fat	99.68
Saturated Fatty Acid(SFA)	14.45
Mono Unsaturated Fatty Acid(MUFA)	43.02
Poly Unsaturated Fatty Acid(PUFA)	42.21
Trans Fat	BQL(LOQ:0.001)
Cholesterol	BQL(LOQ:1.0)
Energy(By Calculation)	889.5
Carbohydrate(By Difference)	BQL(LOQ:1.0)
Protein(Nx6.25)	BQL(LOQ:1.0)
(Ref. AOAC Method Edn.2012,FAO Method)	

BQL Below Quantification Limit LOQ Limit of Quantification

Figure1 Nutritional value of Castor oil



Citric Acid

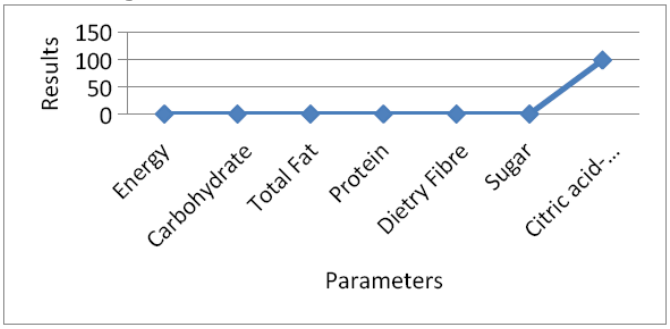
Citric Acid is a compound originally derived from Citrus fruits. More than Two Million tons of Citric acid are manufactured every year. It is used as a Preservative and a Chelating Agent. It is also used as a Emulsifying Agent in Ice cream.

Table2 Nutritional value of Citric Acid

PARAMETERS	UNITS	RESULTS
Energy(By Calculation)	Kcal/100g	0
Carbohydrate(By Difference)	0	0
Total Fat	g/100g	0
Protein(Nx6.25)	g/100g	0
Dietary Fibre	g/100g	0
Sugar	g/100g	0
Citric acid–Assay	%	99.56
(Ref.AOAC Method, 21stEd, 2019)		

BQL Below Quantification Limit LOQ Limit of Quantification

Figure2 Nutritional value of Citric Acid



Vinegar

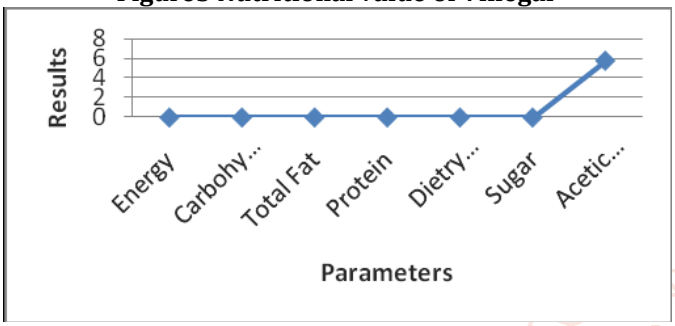
Vinegar means “sour wine”. Vinegar is essentially a dilute solution of Acetic acid in water. Vinegar can be derived out of anything that has alcohol in it.

Table3 Nutritional value of Vinegar

PARAMETERS	RESULTS
Energy(By Calculation)	0 Kcal/100g
Carbohydrate(By Difference)	0
Total Fat	0 g/100g
Protein(Nx6.25)	0 g/100g
Dietary Fibre	0 g/100g
Sugar	0 g/100g
Citric acid–Assay	99.56 %
(Ref. FAO Method AOAC21stEdn.2019,954.02 FSSAIManual)	

BQL Below Quantification Limit LOQ Limit of Quantification

Figure3 Nutritional value of Vinegar



Sodium Chloride

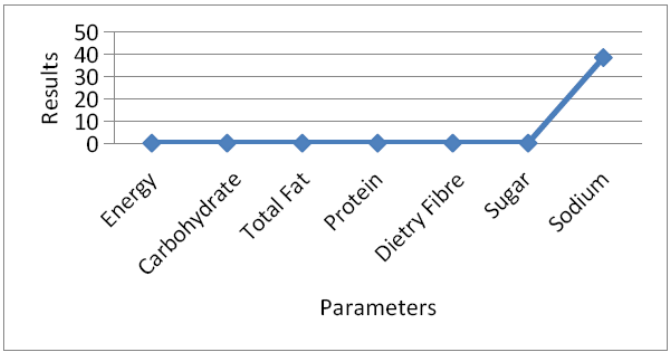
Sodium Chloride is obtained by mining the deposits and brine solution is obtained by passing water into the deposits. Hence the salts get dissolved then the solution is pumped out. It is an ionic compound in which the sodium and chloride ions are in the ratio of 1: 1.

Table4 Nutritional value of Sodium Chloride

PARAMETERS	RESULTS
Energy(By Calculation)	0 Kcal/100g
Carbohydrate(By Difference)	0
Total Fat	0 g/100g
Protein(Nx6.25)	0 g/100g
Dietary Fibre	0 g/100g
Sugar	0 g/100g
Citric acid–Assay	99.56 %
(Ref. FAO Method, AOAC21stEdn.2019,954.02, FSSAI Manual)	

BQL Below Quantification Limit LOQ Limit of Quantification

Figure4 Nutritional value of Sodium Chloride



Sorbic Acid

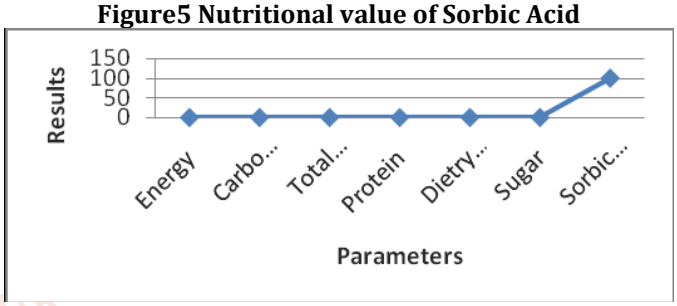
Sorbic Acid is a naturally occurring compound that's become the most commonly used food preservative in the world. It was first isolated from the unripe berries of the Sorbusaucuparia. Sorbic acid is a food preservative which protects many food varieties from yeast and mold spoilage.

Table5 Nutritional value of Sorbic Acid

PARAMETERS	RESULTS
Energy(ByCalculation)	0 Kcal/100g
Carbohydrate(ByDifference)	0
Total Fat	0 g/100g
Protein(Nx6.25)	0 g/100g
DietaryFibre	0 g/100g
Sugar	0 g/100g
Citricacid–Assay	99.56 %
(Ref. FAOMethod AOAC21stEdn.2019,954.02 FSSAIManual)	

BQL Below Quantification Limit LOQ Limit of Quantification

Figure5 Nutritional value of Sorbic Acid



Nutritional values of selected Additives High Fructose corn syrup

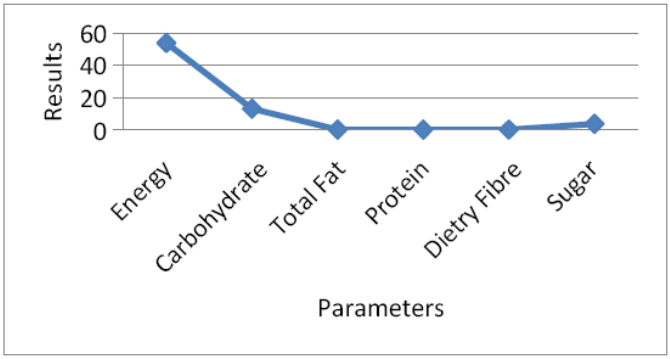
HFCS is derived from corn starch. It helps in easy to store and it extends the shelf life of food. It is also the most widely used sweetener in the Food Industry.

Table6 Nutritional value of High Fructose corn syrup

PARAMETERS	RESULTS
Energy(ByCalculation)	0 Kcal/100g
Carbohydrate(ByDifference)	0
Total Fat	0 g/100g
Protein(Nx6.25)	0 g/100g
DietaryFibre	0 g/100g
Sugar	0 g/100g
Citricacid–Assay	99.56 %
(Ref. FAOMethod AOAC21stEdn.2019,954.02 FSSAIManual)	

BQL Below Quantification Limit LOQ Limit of Quantification

Figure6 Nutritional value of High Fructose corn syrup



Calcium Aluminium Silicate

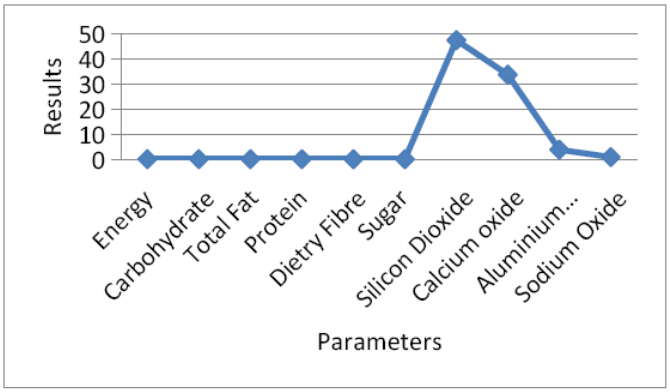
Calcium Aluminium Silicate is derived from naturally occuring limestone and silicone sedimentary rock. It is generally recognized as safe when used as Anticaking agent at levels not exceeding five percent in baking powder, two percent in other food, two percent in animal feed. It is used as Firming agent, Raising agent, Stabilizer, Anticaking agent and Colouring matter.

Table7 Nutritional value of Calcium Aluminium Silicate

PARAMETERS	RESULTS
Energy(ByCalculation)	0 Kcal/100g
Carbohydrate(ByDifference)	0 g/100g
Total Fat	0 g/100g
Protein(Nx6.25)	0 g/100g
DietaryFibre	0 g/100g
Sugar	0 g/100g
SiliconDioxide	47.30%
CalciumOxide	33.60%
AluminiumOxide	3.78%
SodiumOxide	0.85%
(Ref. FAOMethod AOAC21stEdn.2019,954.02, FSSAIManual)	

BQL Below Quantification Limit LOQ Limit of Quantification

Figure7 Nutritional value of Calcium Aluminium Silicate



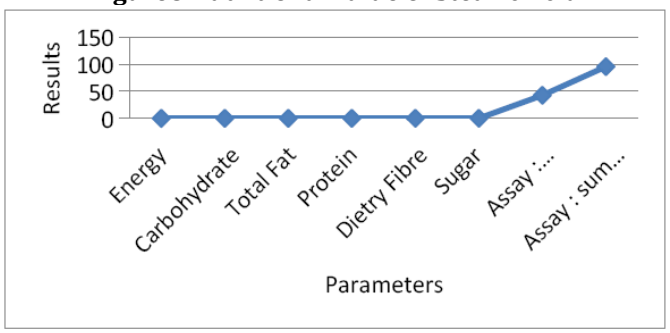
It occurs naturally as a Glyceride in both animal fats and vegetable oil. It has been widely used for many decades in Food industry as an emulsifier, bindes and thickener. It has the European food additives number E570.

Table8 Nutritional value of Stearic Acid

PARAMETERS	RESULTS
Energy(ByCalculation)	0 Kcal/100g
Carbohydrate(ByDifference)	0 g/100g
Total Fat	0 g/100g
Protein(Nx6.25)	0 g/100g
DietaryFibre	0 g/100g
Sugar	0 g/100g
Assay: Stearicacid	42.5 %
Assay: Sum of the stearic acid and Palmitic acid	95.5 %
(Ref. FAOMethod AOAC21stEdn.2019,954.02, FSSAIManual, USP)	

BQL Below Quantification Limit LOQ Limit of Quantification

Figure8 Nutritional value of Stearic Acid



Monosodium Glutamate

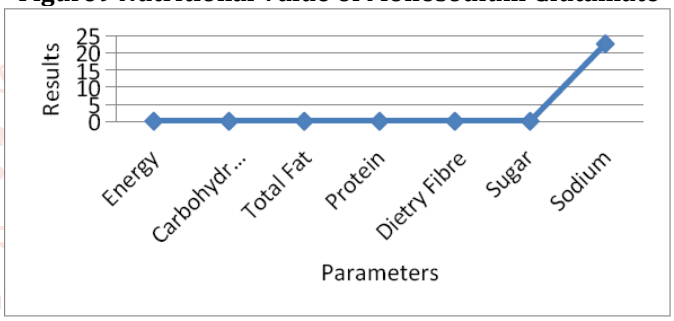
Monosodium Glutamate is derived from the amino acid glutamate or glutamic acid. It is a common food additive with E-number E621. Scavenging assay is an another supporting evidence It is used in canned vegetables, soups and processed meats, salad dressings and instant meals.

Table9 Nutritional value of Monosodium Glutamate

PARAMETERS	RESULTS
Energy (By Calculation)	Kcal/100g
Carbohydrate(ByDifference)	g/100g
TotalFat	g/100g
Protein(Nx6.25)	g/100g
DietaryFibre	g/100g
Sugar	g/100g
Sodium	22.75 g/100g
(Ref. FAOMethod AOAC21stEdn.2019,954.02, FSSAIManual)	

BQL Below Quantification Limit LOQ Limit of Quantification

Figure9 Nutritional Value of Monosodium Glutamate



CONCLUSION

In the study, the common preservatives and additives were selected and tested based on South Indian food industries. Nutritional values ie: energy, carbohydrates, fats, proteins, fibre and sugar were analysed and compared. This study concludes that the preservatives and additives do not have any properties proving them to be respectable natural basis for production of necessary food preservatives and additives that should be used in food industries.

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